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METHODOLOGIES

ON METERING OF THERMAL ENERGY AND HEAT CARRIER

YEREVAN
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Terms and Definitions

Amount (value) registration	Display of images of the measured amount in the form of digits or graphs on the paper.
Metering node	Set of equipment and devices, providing metering of the amount of thermal energy and the mass (volume) of heat carrier as well as control and registration of their parameters
Operation period of the metering unit	Time period when on the basis of meter readings the amount of thermal energy , the mass (volume) of heat carrier is metered and control and registration of their parameters is carried out
Permission to operate the metering node	Procedure, which confirms the availability of the metering node to operate and which becomes ineffective by signing the Act in the defined form.
Metering devices	Devices which determine the amount of thermal energy, the mass of heat carrier, the heat level and the operation period, and which may carry out one or more functions: metering, data acquisition, maintenance and display.
Heat carrier consumption	Amount of heat carrier that passes through the cross-section cut of the pipeline during the unit of time
Heat supply system	Interconnected group of heat sources, thermal networks

	and heat consumption systems.
Heat supply open system	Heat supply system (water system) where the network water for hot water supply is partially or completely taken directly from the system.
Heat supply closed system	Heat supply water system, where the cycling water of the network is not taken from the system.
Heat supply	Provision of thermal energy to the customers
Types of thermal energy loads	Heating, air ventilation, hot water supply for technological and household purposes, air conditioning.
Thermal energy consumer	A legal or physical entity or organization which does not have the status of legal entity, which has demand in thermal energy and which has executed the contract with the corresponding Licensee on thermal energy supply.
Thermal node (TN) (central thermal node CTN)	Complex of equipment for the connection of thermal energy consumption systems to the thermal network and for allocation of thermal energy carrier by types of thermal energy loads.
Independent connection diagram of thermal energy consumers	Diagram of Connection of thermal energy consumers to the thermal network, where the heat carrier supplied from the thermal energy source passes through the heat exchangers installed at the TN and heats the secondary heat carrier used in the thermal network
Dependent connection diagram of	

thermal energy consumers	Connection diagram of thermal energy consumers to the thermal network, where the heat carrier (the network water) supplied from the thermal energy source is directly delivered to the thermal energy consumption systems
Thermal network	System of pipelines and devices for transportation of thermal energy
Balance sheet ownership separation of thermal network	Separation line between the owners of thermal network elements depending on the form of their ownership – leasing or full disposition.
Heat (thermal energy) source	Energy installation for generating of thermal energy.
Thermal meter	Device or set of devices (metering instruments) which determine the thermal energy amount or the heat carrier mass
Thermal energy consumption facility	Complex of facilities consuming the thermal energy for heating, air ventilation, hot water supply, air conditioning purposes and for technological consumption.
Thermal energy consumption system	Complex of thermal energy consuming facilities with connection pipelines or thermal networks
Water-meter (flow-meter)	Metering device for metering of the water (liquid) amount (mass)

Conventional signs

Parameters

t – temperature

p – pressure
h – enthalpy

G – water mass
D – steam mass
Q - thermal energy
T - time

Technological requirements

 measured parameter

 registered parameter

 meter unit

Equipment

 - pump

 - pipeline

 - (valve)

 - heating device

Indexes

1 – supplying pipelines
2 – return pipeline
L – supplementary feeding :
c – condenser
f. w. – feeding water
h. w. – hot water

Metering points of:

 Temperature,

 Pressure

 use of heat carrier

INTRODUCTION

These Methodologies on Metering of Thermal Energy And Heat Carrier (hereinafter, referred to as the Methodologies) are developed according to the Article 54 of the RoA Energy Law.

The Methodologies shall determine the general technical requirements to the metering of delivery and consumption of thermal energy and heat carrier (network water and water steam), to the implementation of control over their parameters - mass (volume), temperature and pressure, as well as requirements forwarded towards the thermal energy and heat carrier metering nodes (hereafter, metering nodes).

The Methodologies are effective on the territory of the Republic of Armenia and are mandatory for those physical and legal entities, which

- implement generation, transportation, distribution and consumption of thermal energy
- perform design, assembling, repairing and calibration works at the thermal energy and heat carrier metering nodes
- ensure the operation of equipment at the metering nodes
- produce equipment, metering and controlling devices to be included in the set of metering nodes

Settlements between the energy supplier and those consuming organizations which temporarily do not have the thermal energy and heat carrier metering nodes or they are not completely equipped, are implemented in compliance with the provisions specified in Section 6 of these Methodologies.

General Provisions

1.1. The requirements of these Methodologies apply to the supplier and consumer of thermal energy and is aimed at implementation of settlements between them regardless of the installed capacity of the thermal energy source and the thermal loading of the consumer (connected to the network).

1.2. The objectives of the process of metering and registration of delivered and consumed thermal energy are as follows:

implementation of financial settlements between the energy supplying companies and consumers;

control over the thermal and hydraulic regimes of the thermal energy suppliers and thermal energy consumers;

consistence of the parameters of the heat carrier, such as mass (volume), temperature, pressure, to the parameters set forth in the contract executed between the supplier and consumer.

1.3. Calculations received from the thermal energy consumers are implemented based on the readings of the devices for control and metering of the heat carrier parameters, which are permitted to operate as commercial devices, according to the provisions of these Methodologies.

In case when only one consumer is connected to the main pipeline starting from the thermal energy source and that main pipeline is on the balance of that consumer, upon mutual agreement of contract parties it is permitted to implement mutual settlements for the consumed heat on the basis of readings of devices installed in the metering node of the thermal energy source.

1.4. The mutual obligations between the energy supplier and the consumer with regard to calculation of thermal energy and heat carrier and maintenance of regimes of delivery and consumption of thermal energy are determined by the “Thermal Energy Sale/Purchase Contract” (hereafter, the Contract).

1.5. While furnishing the metering nodes it is necessary to be guided by these Methodologies and the existing normative and technical documentation, in particular:

Rules of Thermal Energy Use and Supply;

CH and ? 2.04.07-86 “Thermal Networks”, Construction Rules and Norms;

Technical Rules for Operation of Electric Networks and Plants, 1999, Yerevan;

??????? ????????? ??????? ????? ? ????????? ???????????
????????? ???????????? ?? 50-213-80 ? ????????????
???????????? ?? ?????????? ?? 50-213-80, ?? 50.2.006-94
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????????? ? ??????? ???????? ?????????» ???? 8.563.2-37

As well as by procedures of factories producing meter devices and by the other normative technical documents.

1.6. These Methodologies determine the devices for metering of repletion level of the metering node of heat sources and the least quantity of such devices, which is necessary for furnishing the metering node of the consumer depending on the energy supply scheme and heat load specified in the Contract.

The consumer has the right to install additional metering devices for determination of the amounts of thermal energy and the heat carrier notifying the energy supplier in advance, as well as for control of the parameters of the heat carrier, provided that the consumer will not violate the technology of commercial metering and will not affect the accuracy of metering.

The readings of the additional metering devices are not used in commercial settlements between the energy supplier and the consumer.

1.7. For determination of physical magnitudes, the International System of Units (is used consistent to???? 8.417.81. However, considering that in practice some devices having the classification that corresponds to the Metric System of Units (meter, kilogram-force, second) are widely used in metering of thermal energy, both of the systems are applied to these Methodologies.

In the formulas of these Methodologies the following units of metering are used:

pressure – kg/cm^2
temperature - °C
enthalpy – kcal/kg (kJ/kg)
mass – t
density – kg/m^3
volume – m^3
thermal energy – Gcal (GJ)
time – h

The relationship between the SI System and the Metric System is introduced in the Attachment 1.

2. Metering of Thermal Energy and the Energy Carrier at the Heat Source

2.1. Metering of the delivered thermal energy and the heat carrier in the heat supplying water systems

2.1.1. Metering nodes at the heat sources that are combined heat and power plants, district and other boiler-houses, are installed on each exit of the heat carrier (network water).

Metering nodes should be installed near the balance sheet (ownership) separation line of the pipelines, maximally close to the head valves of the heat source.

It is prohibited to take the network water after the metering node for own consumption of the heat source.

2.1.2. The following parameters should be determined at each metering node of the heat source by means of different devices:

the operation time of metering node, the amount of delivered thermal energy;

the mass (volume) of the heat carrier (network water) delivered from and returned to the heat source, in supplying and return pipelines respectively;

the mass (volume) of the water consumed for the supplementary feeding of the heat supplying system

The average hourly and daily parameters of the heat carrier are determined on the basis of the readings of the metering devices registering those parameters.

2.2. Determination of the amounts of delivered thermal energy and the heat carrier in the heat supplying water systems

2.2.1. The amount of thermal energy delivered from the heat source is determined as the aggregate amount of thermal energy delivered from each exit.
The amount of thermal energy delivered from each exit is determined as the algebraic sum of products of water mass within the separate pipelines (supplying, return and supplementary feeding pipelines) and the corresponding enthalpies. The water mass in supplementary and return pipelines is taken with minuses.

The thermal energy delivered from the heat source is formulated as follows:

$$Q = \left(\sum_{i=1}^{a} G_{1i} \cdot h_{1i} - \sum_{j=1}^{b} G_{h.s.j} \cdot h_{h.s.j} - \sum_{k=1}^{m} G_{s.f.k} \cdot h_{f.w.k} \right) \cdot 10^{-3}, \text{ Gcal} \quad (2.1)$$

where

a – number of metering nodes at supplying pipelines
b - number of metering nodes at return pipelines
c - number of metering nodes at supplementary pipelines
G_{li}, h_{li} – respectively, the mass and enthalpy of the heat carrier delivered through the i^{th} supplying pipeline of the heat source
$G_{h.s.j}$, $h_{h.s.j}$ – respectively, the mass and enthalpy of the heat carrier returned through the j^{th} return pipeline of the heat source

$G_{s.f.k}$, $h_{f.wk}$ - the mass and enthalpy of the heat carrier for supplementary feeding delivered through the k^{th} supplementary pipeline of the heat source.

The average values of enthalpies for the corresponding time-period are determined based on the average hourly temperature measured within the given time-period. The magnitude of enthalpy regardless of its pressure is equal to 4,19t °C, kJ/kg (or tkcal/kg).

2.3. Metering of the delivered thermal energy and the heat carrier in the heat supplying steam systems

2.3.1. The steam metering nodes at the heat sources are installed on each exit of the steam.

Metering nodes should be installed near the balance sheet (ownership) separation line of the pipelines, maximally close to the head valves of the heat source.

It is prohibited to take the heat carrier after the metering node for own consumption of the heat source.

2.3.2. The following parameters should be determined at each metering node of the heat source by means of different devices:

the operation time of devices within the metering node,

the amount of delivered thermal energy;

the mass (volume) of the steam delivered and the condenser returned to the heat source

temperature of cold water used for steam, condenser and for supplementary feeding

pressure of cold water used for steam, condenser and for supplementary feeding

The average hourly parameters of the heat carrier, as well as their average values are determined on the basis of corresponding meter readings.

The principle layout of allocation of points for metering of the heat carrier mass (volume) and the list of parameters to be registered are specified in picture 2.

2.4. Determination of the amounts of delivered thermal energy and the heat carrier in the heat supplying steam systems

2.4.1. The amount of thermal energy delivered from the heat source is determined as the aggregate amount of thermal energy delivered from each exit.
The amount of thermal energy delivered from each exit is determined as the algebraic sum of products of the heat carrier mass within the separate pipes (steam and condensing turbines) and the corresponding enthalpies. The mass of the condenser is taken with minus.

The thermal energy delivered from the heat source is formulated as follows:

$$Q = \left[\sum_{i=1}^{k} D_i \left(h_i - h_{c.w.} \right) - \sum_{j=1}^{m} G_{cj} \left(h_{cj} - h_{c.w.} \right) \right] \cdot 10^{-3}, \text{ Gcal} \qquad (2.2)$$

where,
k – number of metering nods installed at stem turbines

m – number of metering nodes at condensing turbines

D_i h_I - respectively, mass and enthalpy of steam at the i^{th} steam turbine, delivered from the heat source

G_{cj}, h_{ci} – respectively, mass and enthalpy of the condenser at the j^{th} condensing turbine returned to the heat source

$h_{c.w.}$ – enthalpy of the cold water used for supplementary feeding

The average values of enthalpies for the corresponding time-periods are determined based on the measured average hourly temperatures and pressures.

3. Metering of Thermal Energy and Heat Carrier Consumed in the Water Systems

3.1. Organization of metering of the received thermal energy and the hear carrier

3.1.1. The following parameters shall be determined by means of devices within the metering node of the heat consumption closed systems:

operation time period for the metering node devices

received thermal energy

masses (volumes) of the heat carrier received through the supplying pipeline and returned through the return pipeline

masses (volumes) of the heat carrier received by the consumer and returned within the certain time-period

the average hourly and daily temperatures at the supplying and return pipelines of the metering node

In addition, the mass (volume) of the heat carrier consumed for the supplementary feeding in the heat consumption systems of independent connection diagrams should also be determined.

The principle layouts of allocation of points for metering of pressure and temperature and mass (volume) of the heat carrier, as well the list of parameters to be registered are specified in picture 3.

3.1.2. In the closed heat consumption systems, where the load does not exceed 0.5 Gcal/h, the received and returned masses (volumes) of the heat carrier during each hour, as well as the average hourly values of the heat carrier parameters, may not be determined.

3.1.3. The metering node of the amount of thermal energy and the mass and other parameters of the heat carrier should be installed in the thermal node of the consumer, maximally close to the head valves.

Within the systems of heat consumption, where the different types of loads are separately connected to the external thermal network by means of independent pipelines, the metering should be carried out for each load separately considering the requirements specified in points 3.1.1. – 3.1.3.

3.2. Determination of the amounts of the received thermal energy and heat carrier

3.2.1. The amount of the thermal energy received by the consumer within the time-period defined by the Contract, is determined, upon agreement of the consumer, by the energy supplying company based on the readings of the metering devices of the consumer. The formula is as follows:

$$Q = Q_c + Q_l + (G_s + G_{h.w.}) \cdot (h_2 - h_{c.w.}) \cdot 10^{-3}, \text{ Gcal} \qquad (3.1)$$

where,

Q_c - the thermal energy consumed by the consumer by the readings of the thermal meter

Q_l – losses of thermal energy within the distance between the separation line of the consumer's balance sheet and his metering node. This value shall be mentioned in the Contract and be taken into consideration if the metering node is not located directly at the balance sheet separation point.

G_s – the mass of the network water consumed for the supplementary feeding of the consumer heating systems and it is determined by the water-meter readings (is considered in the systems independently connected to the heating network).

$G_{h.w.}$ – the mass of the network water, which was supplied immediately to the hot water supplying networks (is considered in the heat supplying open systems)

$h_{h.s}$ and $h_{c.w.}$ – respectively, the enthalpies of the cold water supplied in the heat source for the network water in the return pipeline and supplementary feeding. Their values are determined based on the metering of corresponding devices averaging them for the observed time-period.

In those systems of heat consumption, where only the mass of the heat carrier is metered by metering devices, the thermal energy amount consumed for each separately connected load is formulated as follows:

$$Q = (G_1 h_1 - G_2 h_2) \cdot 10^{-3}, \text{ Gcal} \qquad (3.2)$$

where,

h_1 and h_2 – respectively, the enthalpies of the network water in the supplying and return pipeline, they are determined in compliance with the readings of the meters at the heat source metering node.

4. Metering of Thermal Energy and the Heat Carrier Consumed in the Steam Supplying Systems

4.1. Process of metering of consumed thermal energy and heat carrier

4.1.1. The following parameters should be metered by means of devices in the metering node at the stem supplying systems:

operation period of devices in the metering node

the mass (volume) of the received steam
the mass (volume) of the returned condenser

the mass (volume) of the steam received per each hour

the average hourly temperature and pressure of the steam

The average hourly values of the heat carrier are determined on the basis of the readings of the meters registering the parameters.

The principle layouts of allocation of points for metering of pressure and temperature and mass (volume) of the heat carrier, as well the list of parameters subject to metering and registration, are specified in picture 4.

4.1.2. The metering node of the parameters of thermal energy, the mass (volume) of the heat carrier and other parameters should be installed in the thermal node of the consumer maximally close to the head valves.

In those heat consumption systems, where different types of thermal loads are connected to the external thermal network separately by independent pipelines, the settlements should be done for each separately connected load.

4.2. Determination of sizes of received thermal energy and heat carrier

4.2.1. The amount of thermal energy received by the consumer within the time-period defined in the Contract shall be determined by the energy supplying company upon agreement with the consumer on the basis of the readings of the metering devices of the consumer. The formula is as follows:

$$Q = Q_c + (D - G_c)\cdot(h_c - h_{c.w.})\cdot 10^{-3},\ \text{Gcal} \qquad (4.1), \text{ where}$$

Q_c – thermal energy consumed by the customer based on the readings of meters of thermal energy

D – the mass of the steam received by the consumer, which is determined by the metering devices of the consumer

G_c – the mass of the returned condenser of the consumer to be determined by the meters of the consumer

h_c and $h_{c.w.}$ – respectively, the enthalpies of the cold water in the heat source provided for the condenser and supplementary feeding

The enthalpies are determined by the readings of the corresponding meters of the metering node installed at the heat source, based on the average pressure and temperature of the observed time-period.

5. Basic Requirements of the Thermal Energy Meters

5.1. General Requirements

5.1.1. The metering devices approved by the Rules of Energy Use and Supply and certified by the authorized entity according to the RoA Law (thermal meters, flow meters (water meters), thermal energy meters, devices registering the heat carrier parameters and other) should be installed in the metering nodes of thermal energy.

If flow meters operating on the principle of alternating drop of pressure of the heat carrier are used in the metering nodes, where the diaphragm, nozzle or other restricting device correspondent to the ?? 50-411-83 requirement are installed, then the metering node should be certified on individual basis by the RoA Departments on standardization, metrology and certification.

5.1.2. Each metering device should be confirmed with the defined periodicity by the authorized entity provided by the RoA Law. Those meters, which have expired their confirmation or/and certification date or which have been excluded from the registration log of metering instruments, are not allowed for operation.

5.1.3. The selection of metering devices used in the metering node of the heat source shall be done by the energy supplying company.

5.1.4. The consumer upon agreement of the energy supplier shall do the selection of devices used in the metering node of the consumer.

5.2. Requirements of the metrologic specifications of the metering devices

5.2.1. These Methodologies determine the amounts of thermal energy, the mass (volume) of heat carrier, water, steam, condenser and the requirements towards the meteorological specifications of the metering devices registering the parameters.

5.2.2. The thermal meters should guarantee the relative error in the metering of thermal energy of the hot water not more than:

5% - when the temperatures difference in the supplying and return pipelines is up to 20 °C

4% - when the temperatures difference in the supplying and return pipelines is more than 20 °C

5.2.3. The thermal meters should guarantee the relative error in the metering of thermal energy of the steam not more than:

5% - within the steam consumption meter scale range of 10÷30 %
4% - within the steam consumption meter scale range of 30÷100 %

5.2.4. The water meters should guarantee the relative error in metering of the heat carrier mass (volume) not more than 2 % within the water and condenser consumption range of 4÷100 %.

The steam meters should guarantee the relative error in metering of the steam mass not more than 3 % within the steam consumption range of 10÷100 %.

5.2.5. The metering error for metering devices registering the heat carrier temperature should not exceed the absolute value defined in the following formula:

$\Delta t = \pm (0,6 + 0,004t)$ (5.1), where

t – the heat carrier temperature

5.2.5. The metering devices registering the heat carrier pressure should guarantee the relative error not more than 2 %.

5.2.6. The time registering metering devices should guarantee the relative error for the current time-period not more than 0.1 %.

6. Metering of Thermal Energy and Heat Carrier in the Heat Source and Heat Consuming Points which do not have Metering Nods or which are not Completely Equipped

6.1. Transitional Provisions

6.1. The heat sources which provide thermal energy to the consumers and which do not have the metering nodes consistent with the requirements of these Methodologies are allowed for temporary operation until the installation of the metering node.

6.2. The consumers have the right to install their own metering node which will be consistent with the requirements of these Methodologies, and to implement mutual settlements with the energy supplying company based on the readings of the metering node devices.

6.2. Metering of Thermal Energy and Heat Carrier in the Heat Source

6.2.1. The amount of thermal energy delivered from the heat source that do not have metering node for thermal energy and heat carrier, and supplied for heating and air ventilation purposes within the time-period defined in the Contract is determined as the sum of the network heat losses and thermal energy used in the heating and ventilation networks of all existing consumers fed from the given heat source:

$$? Q = \sum_{i=1}^{a} Q^{c}_{ih} + \sum_{j=1}^{b} Q^{c}_{jv} + Q_{l}, \qquad (6.1)$$

where,

a and b – the number of operating heating (a) and ventilation (b) networks connected to the heat source

Q^{c}_{ih}, Q^{c}_{jv} - design heat capabilities of the i^{th} heating and j^{th} ventilation networks, respectively. They are determined in compliance with the provisions 6.3.1.- 6.3.3. of the Methodologies.

Q_l –heat losses for the specified period resulted from the thermal insulation of the thermal network and from the flow losses. The losses are determined based on the values of specific normative heat losses by recalculated them for concrete operation conditions of the given plant.

6.2.2. In the heat sources that do not have metering nodes, the delivery of heat for hot water heat supply is allowed upon agreement of the energy supplying company to those consumers being the legal entities, which have flow meters of water used for hot water supply. The flow meter should be consistent to the requirements of these Methodologies and be sealed. The amount of energy consumed for hot water supply in the above heat consuming points is formulated as follows:

$$Q_{h.w.} = G_{h.w}(h_{h.w} - h_{c.w}) \cdot 10^{-3}, \quad \text{Gcal} \qquad (6.2)$$

where,
$G_{h.w.}$ – based on the meter readings of the consumer, the mass of the water used for hot water supply within the specified period

$h_{h.w}$ and $h_{c.w.}$– respectively, the enthalpies of delivered hot and cold water, it is accepted that $t_{h.w.}$=60 °C and $h_{h.w}$ = 4,19 ∗ 60 kJ/kg = 60 kcal/kg.

6.3. Metering of the Consumed Thermal Energy

6.3.1. The amount of thermal energy consumed in the heating and air ventilation systems of consumers being legal or physical entities, including public or residential buildings, is determined as follows:

$$Q_c = Q_h + Q_v,$$

where

Q_h and Q_v – thermal energy consumed in the air ventilation and heating systems of the consumer within the specified period.

The thermal energy amounts are determined in the following way:

$$Q_h = Q^s_{ih} \quad n_h \frac{t_i - t^a_{am.av}}{t_i \quad t^s_{am.h}} \qquad (6.4)$$

$$Q_{jv} = Q^s_{jv} \quad n_v \frac{t_i \quad t^a_{am.av}}{t_i \quad t^s_{am.v.}} \qquad (6.5)$$

where,

n_h and n_v – the operation periods of the heating and air ventilation systems, respectively, during the specified period

t_i – the design temperature inside the heated (ventilated) buildings

$t^a_{am.av}$ – the actual averaged ambient temperature during the specified period

$t^d_{am.h.}$ and $t^d_{am.v.}$ - the design ambient temperatures during the specified period for projecting of heating and ventilation systems, respectively.

Q^d_{ih} and Q^d_{jv} – the design thermal capabilities of the i^{th} heating system and j^{th} ventillation systems.

6.3.2. The design capabilities of the consumers heating systems are determined based on their projects. In case of absence of projects, the heat load for industrial buildings is determined on the basis of ministerial norms or the projects of similar buildings. For determination of the design capability of the heating system of residential and public buildings the following formula is used:

$$Q^c_h = q_0 \quad A \quad 10^{-6} \quad MW = 0.86 \cdot q_0 \cdot A \cdot 10^{-6} \text{ Gcal/h} \qquad (6.6)$$

or

$$Q^c_h = q_h \quad V \quad \left(t_i - t^d_{am.\,h}\right) \quad 10^{-6} \quad MW = 0.86 \cdot q_h \cdot V(t_i - t^d_{am.\,h}) \cdot 10^{-6} \text{ Gcal/h} \qquad (6.7)$$

where,
q_0 – the amount of thermal energy required for heating of residential buildings per m^2, the values are provided in Appendix 2.

A – the total surface of the residential building

q_h – the specific value of heating of the residential or public building (see Appendix 2)

V – the size of the building by external dimensions.

The formula (6.6) is suggested by ? ? and ? 2.04.07-86 for calculation of the total heat load of the residential areas. The sizes of separate buildings, the height of the stores, the building constructions are not taken into consideration. From that perspective, it will be more reasonable to determine the heat design load for separate buildings by means of the other formula (6.7). In other cases, upon agreement of parties it is allowed to calculate the thermal energy delivered based on the capacity of the pipeline and the average decrease of temperature.

6.3.3. The amount of thermal energy for air ventilation is calculated only for those consumers, which have mechanical air ventilation systems during the heating season.

The design load for air ventilation of industrial buildings is determined on the basis of projects, and if projects are not available – based on the ministerial norms or the projects of similar buildings.

The design capacity of thermal energy for air ventilation of public buildings is also determined on the basis of projects, and if projects are not available it is calculated as follows, based on ? ? and ? 2.04.07-86:

$$Q^d_v = (0.4 \div 0.6)\, Q^d_h$$

6.3.4. The amount of thermal energy for the reported period distributed from the thermal node is determined by formula (6.1) as the arithmetic sum of thermal energy received by all consumers fed from the node and heat losses at thermal networks.

If any consumer fed from the thermal node has its metering node, then the settlements of the energy supplying company are implemented based on the readings of devices of that metering node.

Appendix 1

RATIO OF METERING UNITS OF PHYSICAL VALUES IN THE METRICAL AND SI SYSTEMS OF UNITS

Value	Measuring units		Conversion factor
	Metric system	SI system	
Line	m sm mm	m	 10^{-2} m 10^{-3} m
Mass	t kg	kg	10^{3} kg
Time	sec hour day	sec	 3600 sec 86400 sec
Temperature	^{0}C	K	t [^{0}C]+273K
Pressure	kg/sm^{2} mm of w mm of m bar	Pascal	98100 Pa = 98,14 kPa = 0,0981 MPa 9,81 Pa 133,3 Pa 10^{5} Pa = 100 kPa = 0,1 MPa
Mass consumption	kg/h t/h	kg/sec	$2{,}78 \cdot 10^{-4}$ kg/sec 0,28 kg/sec
Energy (heat amount)	cal kcal Mcal Gcal	Joule (J)	4,187 J 4187 J = 4,187 kJ $4{,}187 \cdot 10^{6}$J = 4,187 MJ $4{,}187 \cdot 10^{9}$J= 4,187 GJ
Enthalpy	kcal/kg	J/kg	4187 J/kg
Thermal flow, Capacity	kcal/h Gcal/h	W	1,163 W $1{,}163 \cdot 10^{6}$ W = 1163 kW = 1,163 MW
Specific heat	kcal/kg ^{0}C	J/kgK	$4{,}187 \cdot 10^{3}$ J/kg·K = 4,187 kJ/ kg·K

Note: if the heat carrier consumption is measured in units of volume, then its mass will be equal to

$$G=0{,}001\, G_{0*p}$$

where, G_0 - the consumption in units of volume (m_3), p - density (kg/m_3)

Appendix 2

A. DESIGN THERMAL ENERGY M^2 FOR HEATING OF RESIDENTIAL BUILDINGS, q_0, W/(?? and ? 2.04.07-86¤

Number of stores	design temperature of the ambient air for heating $t^d_{am.h}$, ^{0}?				
	-5	-10	-15	-20	-25
for buildings constructed by 1985					
1-2	148	154	160	205	213
3-4	95	102	109	117	126
5 and more	65	40	77	79	86
for buildings constructed by 1985Ã and after					
1-2	145	152	159	166	175
3-4	74	80	86	91	97
5 and more	65	67	70	73	81

Note: The values of q_0 for the other design temperatures of the ambient air are determined analogically.

B SPECIFIC VALUES OF HEATING OF RESIDENTIAL AND PUBLIC BUILDINGS, q_0, W/$m^{3\,0}$?

Types of	Size of the building by its external dimensions , Ù^3										
	up to 500	500÷ 700	700÷ 1000	1000 ÷ 2000	2000 ÷ 3000	3000 ÷ 5000	5000 ÷ 7000	7000 ÷ 10000	10000 ÷ 15000	15000 ÷ 20000	20000 and more
Stone-wall building	0,86	0,77	0,72	0,64	0,60	0,53	0,50	0,48	0,44	0,40	0,38
Bearing-wall and block buildings	-	-	-	-	0,73	0,65	0,61	0,56	0,50	0,50	0,50

Note:

1. The specific values of heating were determined on the basis of data analysis implemented by the Ministry of Residential Utilities during the years 1982-83 regarding the numerous buildings constructed by planned and individual projects.

2. The adjustment factor depending on the design temperature of the ambient air is not included, since the same building constructions (from the technical viewpoint) are used in all climatic zones of Armenia.